$x(n)$ to obtain an extended chirp sequence, $x((n))_{P,N}$, wherein chirp refers to a linear frequency modulation and p is the order of Fractional Fourier Transform, and wherein the conversion equation for the p-order chirp periodic extension is:

$$x(n-N)e^{j\frac{1}{2}\cot\alpha\cdot(n-N)^2\Delta t^2} = x(n)e^{-j\frac{1}{2}\cot\alpha\cdot n^2\Delta t^2} \tag{9}$$

wherein $\alpha=p\pi/2$, and Δt is the sampling interval.

[0062] (3) Shift $x((n))_{P,N}$ to the right by iM (i is 1, 2, . . . , L) points to get $x((n-iM))_{P,N}$, which further multiplies by $R_N(n)$ to obtain chirp circular displacement of FRFT-OFDM signal, $x((n-iM))_{P,N}R_N(n)$, wherein L is the length of the random phase sequence; M=N/L,

$$R_N(n) = \begin{cases} 1 & 1 \le n \le N-1 \\ 0 & \text{other} \end{cases}.$$

[0063] (4) Multiply $x((n-iM))_{P,N}R_N(n)$ by

$$\eta(n, i) = e^{j\frac{1}{2}\cot\alpha\cdot[-2\cdot iM\cdot n+(iM)^2]\Delta t^2}$$

point-by-point to obtain $\phi(n,i)$ as the following:

$$\phi(n,i)=x((n-iM))_{P,N}R_N(n)\cdot\eta(n,i), i=0,1 \ldots L-1, n=0,1, \ldots, N-1. \tag{10}$$

[0064] (5) Multiply $\phi(n,i)$ by weighting factors, $r^{(l)}(i)$, and use a combiner to obtain candidate signals $\tilde{x}^{(l)}(n)$ of FRFT-OFDM in the time domain as the following:

$$\tilde{x}^{(l)}(n) = \sum_{i=0}^{L-1} r^{(l)}(i)\cdot\varphi(n, i),\ n = 0, 1 \ldots N-1,\ l = 1, 2, \ldots S \tag{11}$$

wherein $r^{(l)}(i)$ is the weighting factor with L-length, and S is the number of alternative Fractional random phase sequence.

[0065] (6) Transmit the weighting factor $r(i)_{opt}$ that makes PAPR of candidate signals minimum as the sideband information of FRFT-OFDM signals, wherein

$$r(i)_{opt} = \underset{\{r^{(1)}(i),\ldots,r^{(S)}\}}{\operatorname{argmin}}\ PARP\ \{\tilde{x}^{(l)}(n)\} \tag{12}$$

[0066] (8) Use a DAC to convert the transmitting FRFT-OFDM signals with minimum PAPR to analog signals which are further amplified by a HPA after modulated by carrier.

[0067] (9) Finally, submit the amplified analog signals to a transmitting antenna.

[0068] In order to illustrate the effectiveness of the method of the present invention, a simulated example and analysis are given below. With the increasing number of subcarriers, the performance difference of PAPR in FRFT-OFDM system which is led by the difference of order can get smaller and smaller. When the number of subcarriers is very large, the PAPR distribution of FRFT-OFDM system with different orders become consistent. We take the order of 0.5 in the following example, and other simulation parameters are shown in Table 2.

TABLE 2

simulation parameters

Parameters	Parameter values
MonteCarlosimulation	10^5
Number of subcarrier number	256
Digital modulation	QPSK modulation
Channel type	Gauss white noise channel

[0069] Table 3 gives the main calculation quantity and the number of complex multiplications under the simulation example. At this point, the method of the invention, the weighting factor is $r^{(l)}(i)\in\{1, -1, j, -j\}$ We take the elements of the random phase sequence to $P_k^{(u)}\in\{1, -1, j, -j\}$ with the method of SLM. With the method of PTS, phase factor is $a_k^{(\lambda)}\in\{1, -1, j, -j\}$. The present method has lower computational complexity than that of the SLM and PTS methods.

TABLE 3

Comparison of the computation complexity of SLM, PTS and the present method

Method	Main calculation	Times of complex multiplication
SLM, M_1 = 32	IDFRFT with 32-time and 256-point, resulting in alternative 32 signals	49152
PTS, M_2 = 32, K = 4	IDFRFT with 4-time and 256-point, resulting in alternative 32 signals	6144
The method of this invention, S = 32, L = 4	IDFRFT with one time and 256-point, resulting in alternative 32 signals	2560

[0070] FIG. **6** is the comparison of the BER performance before and after the PAPR reduction method is introduced into an FRFT-OFDM system. From FIG. **6**, it can be seen that the BER perfomance before and after the PAPR reduction method is introduced into an FRFT-OFDM system is quite similar. This shows that with the method of the invention, the receiving end can accurately recover the information of the sending end.

[0071] FIG. **7** is the comparison of the PAPR reduction using the method of the present invention when L=2,4. From FIG. **7**, it can be seen that the method can effectively improve the PAPR distribution of the system. When L=2, the PAPR of the system was reduced by about 2.0 dB than that without using PAPR suppression. When L=4 and CCDF=10^3, the system PAPR is reduced by about 1.5 dB. It is shown in Table 1 that with the increasing value of L, the computational complexity of the method also increases accordingly.

[0072] FIG. **8** is a comprison of the PAPR reduction by the SLM method, the PTS method, and the method of the present invention when the number of candidate signals is 32 and the sampling factor J =1. From FIG. **8**, it can be seen that when CCDF=10^{-3}, the PAPR suppression effect of the present method is slightly worse than that of the SLM method. However, from the Table 3, it can be seen that the